ARY A. SALIBE

# *Scion-Rootstock Incompatibilities in Brazil*

A NUMBER OF scion-rootstock incompatibilities have been observed in citrus trees in Brazil. This paper reports additional observations and studies on bud-union incompatibilities in citrus at the Limeira Citrus Experiment Station, Instituto Agronomico, Campinas, S. Paulo, Brazil.

## *Lemons on Trifoliate Orange and Trifoliate Hybrid Rootstocks*

In 1 tree of Eureka lemon on trifoliate orange rootstock remaining out of 5 trees planted in 1944, marked symptoms of bud-union incompatibility similar to those described by Weathers *et al.* (6) in California were observed. Buds from that old-line Eureka lemon were used in the citrus planting at the Tietê Experiment Station, where similar bud-union disorders in trees on trifoliate orange were observed by Grant *et al.* (1). From a total of 57 trees of Eureka lemon on trifoliate orange rootstock, only 5 are still alive, in 3 citrus rootstock plantings.

In a 10-year-old Eureka lemon planting, bud-union incompatibilities were noticed, varying from severe to slight, on the following trifoliate hybrids: Savage and Rusk citranges (severe), Uvalde (medium), Cunningham and Morton (slight).

Seven old-line lemon varieties and 2 old-line acid lime varieties, as well as nucellar lines of some of these varieties, were budded on trifoliate orange and Troyer citrange rootstocks. The occurrence of normal and abnormal bud unions, 2 years after budding is shown in Table 1 and in Figure 1,A. Generally, symptoms of incompatibility were more severe on trifoliate orange than on Troyer citrange.

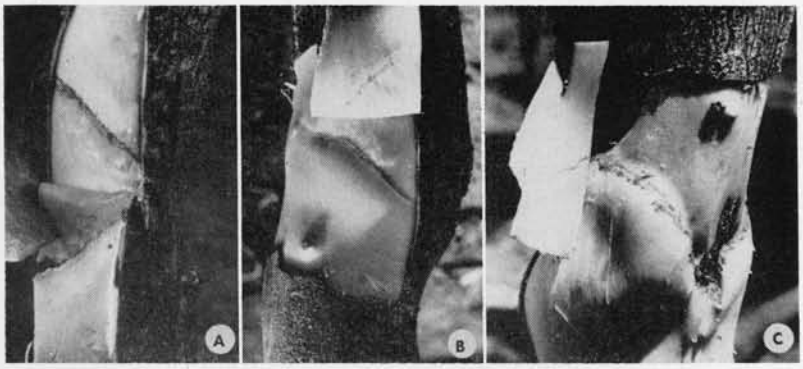


FIGURE 1. *Bud union incompatibilities. A. Nucellar-line Siciliano lemon on trifoliate orange. B. Old-line Seleta de Itaborai orange on Florida rough lemon. C. Old-line calamondin on Brazilian rough lemon.*

TABLE 1. NUMBER OF TREES OF VARIOUS SCION VARIETIES ON TRIFOLIATE ORANGE AND TROYER CITRANGE ROOTSTOCKS, SHOWING NORMAL AND ABNORMAL BUD UNIONS, 2 YEARS AFTER BUDDING

| Scion Variety | Rootstock | | | |
|---|---|---|---|---|
| | Trifoliate | | Troyer citrange | |
| | abnormal bud union | normal bud union | abnormal bud union | normal bud union |
| L. Eureka | 14 | 0 | 7 | 0 |
| L. Eureka (nucellar 1) | 4 | 0 | 5 | 0 |
| L. " " 2 | 5 | 0 | 5 | 0 |
| L. " " 3 | 3 | 0 | 5 | 1 |
| L. " " 4 | 5 | 0 | 3 | 0 |
| L. " " 5 | 5 | 0 | 5 | 0 |
| L. Siciliano | 6 | 0 | 6 | 0 |
| L. Siciliano (nucellar) | 6 | 0 | 5 | 0 |
| L. Lisboa | 0 | 7 | 0 | 7 |
| L. Perrine | 0 | 9 | – | – |
| L. Perrine (nucellar) | 0 | 9 | – | – |
| L. Acido | 0 | 8 | – | – |
| L. Acido (nucellar) | 0 | 8 | – | – |
| L. Ponderosa | 1 | 2 | 0 | 4 |
| L. Ponderosa (nucellar ?) | 4 | 0 | 8 | 1 |
| L. Tahiti | 0 | 5 | 0 | 3 |
| L. Harris | 8 | 0 | – | – |
| L. Galego | 0 | 4 | 0 | 4 |
| L. Galego (nucellar) | 0 | 4 | 0 | 4 |

## *Sweet Orange Varieties on Florida Rough Lemon and Trifoliate Orange Rootstocks*

Since Moreira (3) previously reported symptoms of a bud-union disorder in trees of Pera and Seleta de Itaborai (Coroa do Rei) oranges on sour orange rootstock, it seemed of interest to observe the behaviour of these varieties on trifoliate orange as well as on Florida rough lemon. Buds from an old-line and a nucellar-line Pera and Seleta de Itaborai oranges were budded on Florida rough lemon and trifoliate orange. Observations at the bud union, 2 years after budding, are summarized in Table 2. Severe symptoms of bud-union incompatibility were found in trees of both sweet orange varieties on both rootstocks (Fig. 1,B).

TABLE 2. NUMBER OF TREES OF VARIOUS SCION VARIETIES ON FLORIDA ROUGH LEMON AND TRIFOLIATE ORANGE ROOTSTOCKS, SHOWING NORMAL AND ABNORMAL BUD UNIONS, 2 YEARS AFTER BUDDING

| Scion Variety | Rootstock | | | |
|---|---|---|---|---|
| | Florida rough lemon | | Trifoliate | |
| | abnormal union | normal union | abnormal union | normal union |
| Seleta de Itaboraí | 6 | 0 | 6 | 0 |
| Seleta de Itaboraí (nucellar) | 3 | 3 | 6 | 0 |
| Pera | 5 | 5 | – | – |
| Pera (nucellar) | 2 | 8 | 2 | 4 |

## *Calamondin on Rough Lemon Rootstock*

Calamondin is not grown commercially in Brazil. It was used some years ago as rootstock in a Eureka lemon planting. Two years later all trees were dead.

In 1957, buds from an old-line and a nucellar-line calamondin were budded on Brazilian and Florida rough lemon seedlings. Three years later, a severe indentation in the wood and heavy gum accumulation were observed at the bud union in all trees on Brazilian rough lemon (Fig. 1,C). All trees on Florida rough lemon rootstock had a normal bud union. However, the Florida rough lemon had small pits in the wood and corresponding pegs in the bark below the union, as well as a wood discoloration similar to that caused by xyloporosis virus. In all trees the calamondin top exhibited pits and pegs, probably due to tristeza.

## *Some Citrus Varieties on Cleopatra Tangerine Rootstock*

During a recent trip through the citrus areas in Argentina, Moreira (personal communication) observed bud-union disorder symptoms in trees of Lue Gim Gong orange on Cleopatra tangerine rootstock, similar to those described by Grimm *et al.* (2) and Grant *et al.* (1) for sweet orange tops on Florida rough lemon rootstock. At the Limeira Citrus Experiment Station, 3-year-old trees of 6 sweet oranges, 4 tangerines, 36 lemons, 16 acid limes, 8 sweet limes, and 6 citron varieties were examined but no abnormal bud union was observed.

## *Discussion*

The bud-union symptoms observed in trees of all scion-rootstock combinations showing incompatibility are very similar. They are essentially the same as those described by Weathers *et al.* (6) for nucellar-line Eureka lemon on trifoliate orange and Troyer citrange rootstocks and by Grimm *et al.* (2) for sweet oranges on Florida rough lemon rootstock.

The cause of these incompatibilities being still unknown makes it difficult to explain the different behaviour of the Eureka lemon and the Pera and Seleta de Itaborai oranges when grafted on trifoliate orange and Florida rough lemon rootstocks. Both sweet orange varieties showed bud-union incompatibility on both rootstocks, but Eureka lemon, which shows bud-union incompatibility on trifoliate orange rootstock, had a normal union on Florida rough lemon.

The Pera sweet orange variety shows abnormal bud union on Florida rough lemon and normal on Brazilian rough lemon, whereas the calamondin shows an opposite behaviour, that is, normal bud union on Florida rough lemon and abnormal on Brazilian rough lemon rootstock.

Many suggestions have been made to account for the bud-union abnormalities. Some authors (2, 6) suggested that a virus might be the cause. A possible relationship with cachexia has also been proposed (1, 2). To accept a virus cause as an explanation for these incompatibilities, one should admit either that the virus is seed-transmitted or that it has an efficient vector.

A true incompatibility inherited genetically has also been presented as a possible explanation (2, 6, 7). This explanation, as was discussed by Weathers and Calavan (7), would be in disagreement with the view expressed by Webber (5) about the degree of congeniality.

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